PHOTOVOLTAIC RESEARCH AT GRC:

- Solar power (and methane?) to explore Mars
- Solar power for the space station and the Moon
- Mars solar airplane

Solar power (and methane?) to explore Mars

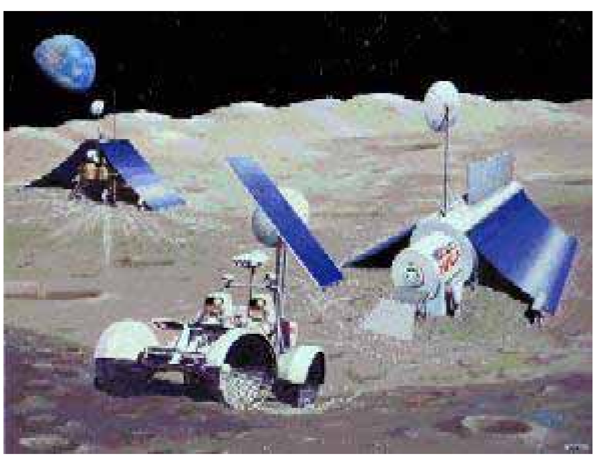
Exploring the surface of Mars requires power, but where does the fuel come from? One power system is a photovoltaic array. But Mars is a challenging environment for the use of solar power. We experience less bright sunlight on Mars than we do in Earth's orbit, plus the twelve-hour night (although not as severe as the moon`s 14 day darkness) means that any solar power system must have a large storage system. Plus, the Mars environment is not a friendly one: Wind, low temperature, sand, dust, and corrosive peroxide-rich soil.

Photovoltaics provides low-cost power with high reliability and no moving parts. It has powered the space program since Vanguard, and there is every reason to believe it will play a major role in the exploration of Mars.

GRC is also studying the use of this photovoltaic technology to manufacture methane (natural gas) from Mars carbon dioxide to use as a propellant.
http://powerweb.grc.nasa.gov/pvsee/publications/mars/marspower.html
Researchers: Geoffrey A. Landis and Joseph Appelbaum

Solar power for the space station and the Moon

Since the launch of Vanguard in 1957, photovoltaic power (solar cells) have been the workhorse of the space program, powering all but a handful of satellites and deep space probes.



A lander, a habitat, and a rover for a lunar expedition.

All use photovoltaic (solar) power.

Since the Vanguard launch, solar cells have increased greatly in performance. The crude cells on Vanguard were only 5% efficient. The International Space

Station will, for example, use 14.5% efficient large-area silicon cells. 19% efficiency is available with gallium arsenide cells. And efficiencies as high as 30% have been demonstrated in the lab with small area cells under concentrated sunlight.

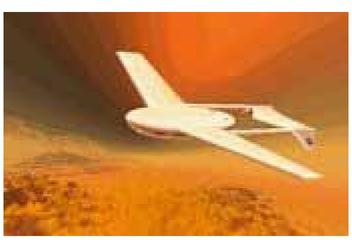
The largest solar arrays currently flying, those on the Russian Mir space station, are more than ten thousand times the power of the tiny solar array on Vanguard. Mir has a total peak power capacity of about 40 kW. For comparison, a typical household might have 5 kW of electrical service, and typically use 2 kW. But requirements for future space missions will make these arrays look tiny.

One of the most important future missions that will require large amounts of power will be a lunar base. Click below to read more about lunar camps, operation of panels, and a moon buggy.
http://powerweb.grc.nasa.gov/pvsee/programs/solarmoon.html
Page by Geoffrey Landis, 1997

Mars solar airplane

One of the most studied airborne platforms for Mars is the airplane. In the early 1990's, a solar aircraft concept was generated by NASA GRC. Powered by solar cells during the day and a regenerative fuel cell at night, this concept would allow the aircraft to fly continuously for up to a year.

On February 1, 1999, NASA Administrator Daniel Goldin, announced the Mars micromission in which the first Mars airplane mission would arrive on the Red Planet around December 17, 2003, the centennial of the Wright brother's first flight. A team composed of members from four NASA centers (Ames, Dryden, Langley, and Glenn) was formed to generate conceptual designs for the micromission airplane.



The plane would carry three cameras, a near infrared spectrometer to study the mineralogy of the planet, and a magnetometer to characterize the magnetic properties of the planet's crust. Although the conceptual design of the plane was completed and initial risk reduction testing begun, the project was cancelled due to funding constraints.

NASA did not abandoned the idea of a flight vehicle on Mars, however. At the direction of NASA Headquarters, a six year planetary aircraft technology development program was formulated. The program was to begin development, with the first Earth-based flight to take place in December 2003.
http://powerweb.grc.nasa.gov/doc/marsairplane.html
Compiled by: R. Chock 8-7-2002

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